Cook-Chill Method for Retail and Restaurants

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FOOD FROM THOUGHT

THE FOOD PROCESSING CENTER

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Outline

- History
- Cook Chill Defined
- Definitions and Terms
- Cook chill Process Steps and Safety
- Regulations
- Processing Considerations
- Summary

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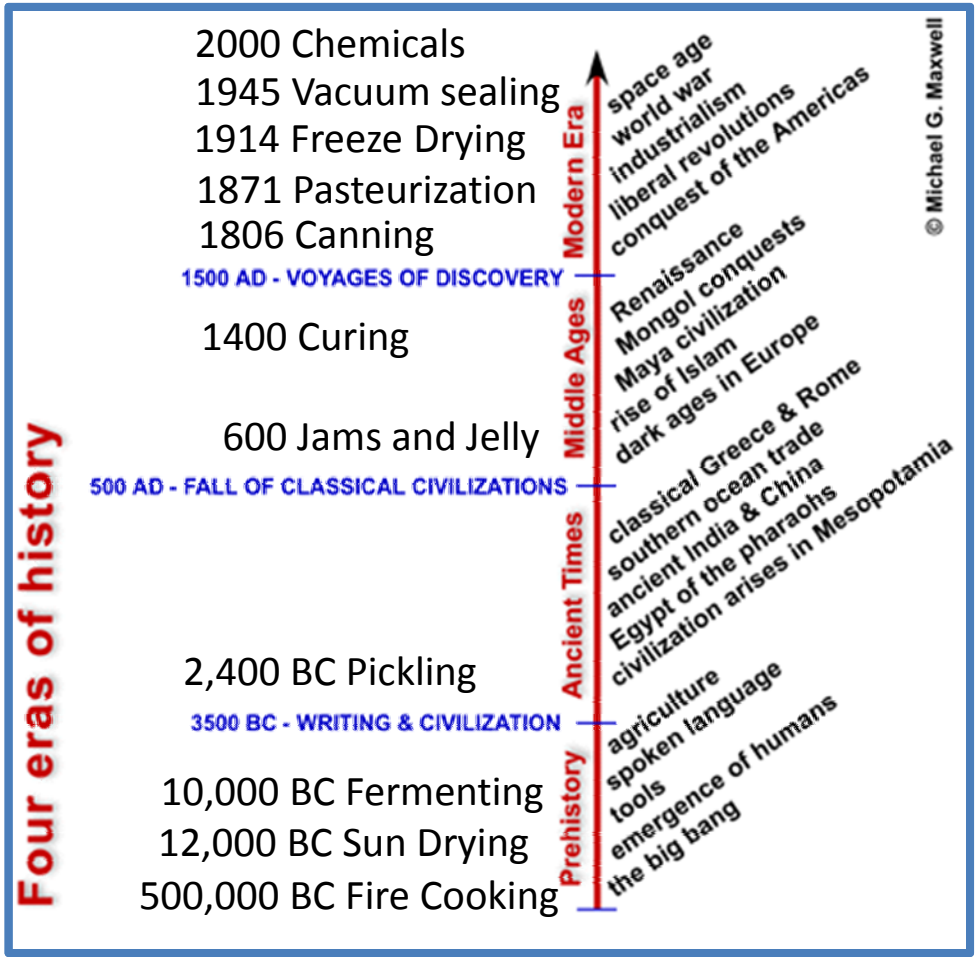
History of Food Preservation

Over the course of history,

Food preservation has played a crucial role in alleviating hunger and famine

and was instrumental in supplying edible foods for armies, voyagers and explorations

that led to significant changes in human history.



Processing, Storage and Quality of Cook-Chill or Cook-Freeze Foods (2014)
Atef Elansari, Alaa El-Din A. Bekhit; in Minimally Processed Foods, pp. 125-150.

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History of Food Preservation

Progress → Four main processing paradigm shifts

Step	Shift	Timeline
1	Production of safe foods	Early humans-1950's
2	Production of safe foods that have desirable sensory properties; looks and tastes good	1960's-1980's
3	Production of safe high quality food that is nutritionally sound	1990's-2000s
4	Production of safe nutritious high quality food that delivers specific functions	2000s-present

Processing, Storage and Quality of Cook-Chill or Cook-Freeze Foods (2014)
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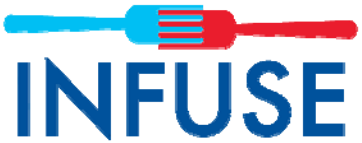
Innovation:
-Science
-Engineering



History of Food Preservation

Hence, the food industry moved from primitive concepts, such as simple dehydrated products and cured foods, to technologies such as canning, refrigeration and freezing.

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What is Cook-Chill?

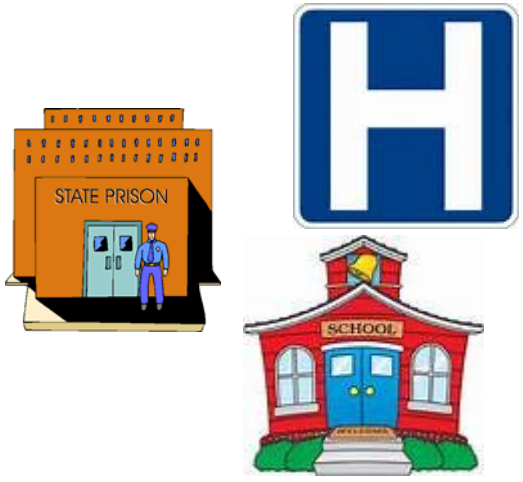
Cook-Chill – a utilized process of food preparation that involves the rapid chilling of cooked food – food is then reheated at a later date as needed

Origins

The concept of cook-chill arose primarily through the need to produce quality food products in advance in a highly reproducible way while providing maximal food safety.

This was introduced during the 1960s for catering purposes; reliable refrigeration systems. High electricity and equipment costs, cook-chill began to fade.

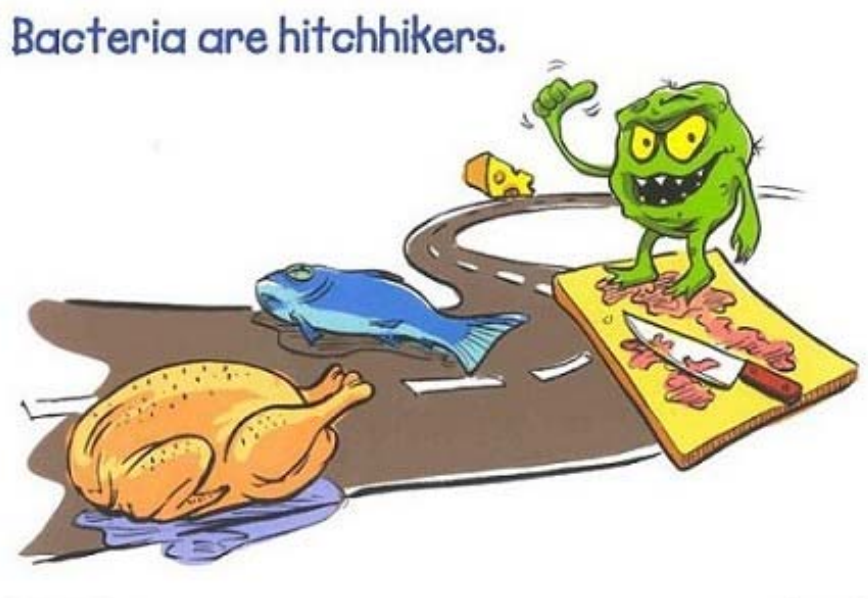
Increased in the early 1990s when it was utilized in institutional settings due to energy efficiency improvements.



http://katiegarrett.weebly.com/uploads/1/3/2/3/13233731/hospital_food_production_research_paper.pdf

Why Use Cook-Chill?

- Food Safety
  - Less human product contact
  - Safer handling of food since it is in a pouch
  - Pathogenic organism control
  - Spoilage organism control
- Reduces Cross Contamination
- Help prevent foodborne illness



Picture from http://health-it.wikispaces.com/file/view/40400.jpg

Nummer, Brian. Cook-chill reduced-oxygen packaging in retail and foodservice operations. Food Safety Magazine. Process Control. June/July 2010. https://www.foodsafetymagazine.com

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Why Use Cook-Chill?

Food Quality

- Extends shelf life
- Maintains taste and texture
- Product consistency
- Product appearance

Reduced Product Loss

- Product portioning
- Loss in pans/pots
- Burnt product (Sous Vide)

Reduced Labor Costs

- Increase food profitability
- Increase process profitability

Nummer, Brian. Cook-chill reduced-oxygen packaging in retail and foodservice operations. Food Safety Magazine. Process Control. June/July 2010. https://www.foodsafetymagazine.com

But……

Photo from: http://feelgrafix.com/data_images/out/28/998551-compliance.jpg

- Many guidelines, rules, and regulations that must be followed
  - Creates unique food safety issues

We will discuss the regulations throughout this presentation

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Cook-Chill Applications

Can be used on all types of food products:

Meat
(beef, pork, lamb)

Fish
(frozen only)

Fruits
vegetables

Stocks
sauces

Poultry

Desserts, custards

Oils, condiments

Cheeses

Note: Only frozen fish may be sous vide cooked.
Only cheeses that meet standard of identity in 21 CFR 133.150 Hard cheeses, 21 CFR 133.169 Pasteurized process cheese or 21 CFR 133.187 Semisoft cheeses can be cook-chill processed

Many others….

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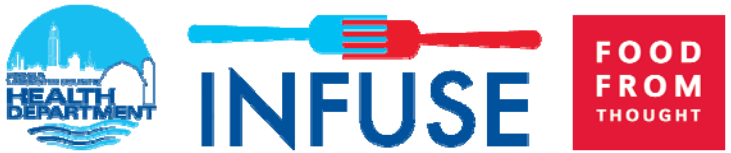
We Will Go Through The Process

But first…



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Terms to Consider

- **Food preparation** – involves the blending, slicing, chopping of raw ingredients, meats, vegetables and any other steps to prepare the food for consumption. May also include:
  - Bagging (prior to or after cooking)
  - Cooking of the food depending on the process
- **Cook** – Prepare food by heating or transform for consumption by heating

Terms to Consider

- **Chill** – Make cold or process of become cooler (falling temperature)
- **Cook-Chill** – a utilized process of food preparation that involves the rapid chilling of cooked food – food is then reheated at a later date as needed

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Terms to Consider

- **Cook-in-Bag** – cooking technique where food is placed into a sealed bag, partially heated or fully cooked in a water bath or steam chamber at specific temperatures, and then chilled (optional)

- **Sous Vide** – [so͞o ˈvēd] French food preparation method or technique meaning under vacuum, where the food is placed into a vacuumed-sealed pouch, partially heated or fully cooked in a water bath or steam chamber at specific temperatures, and then chilled (optional)

https://www.sousvidesupreme.com/. 2016, Baldwin, D. 2012. Sous vide cooking: A Review. International Journal of Gastronomy and Food Science 1 (2012).

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Terms to Consider

- **Foodborne Pathogen** – Any microorganism that has the potential to cause disease and resides in food
- **Reduced Oxygen Packaging (ROP)** – Any food pouch where the oxygen content has been reduced to below 21%. Includes; Ziploc, heat sealed, modified atmosphere, and vacuumed sealed pouches, etc.
- **Shelf Life** – Amount of time after preparation that a food retains its quality and remains fit for consumption

https://www.sousvidesupreme.com/. 2016, Baldwin, D. 2012. Sous vide cooking: A Review. International Journal of Gastronomy and Food Science 1 (2012).

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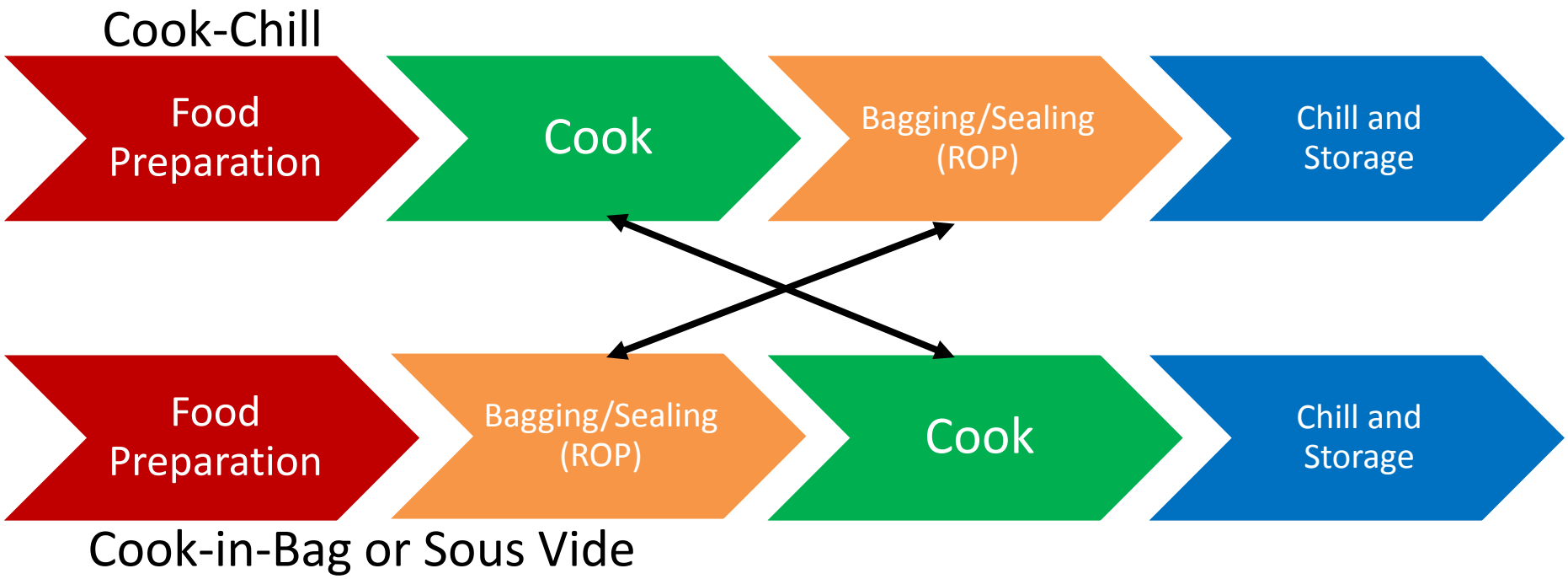
Cook-Chill Processes – 2 Methods



Cook-Chill vs Cook-in-Bag

Cook-Chill

- Used with all types of cooking methods
  - Baking, roasting, steaming, etc.
- Cook at higher temperatures
- Food hot filled into pouch prior to cooling to below 57°C (135°F)

Cook-in-Bag and Sous Vide

- Normally used for long cook processes (1-7 hours or longer)
  - Can be ≥48 Hours
- But…Focused on temperature not time
  - Typical Temperatures (lower)
    - 55-70°C (meats)
    - Higher temps for vegetables

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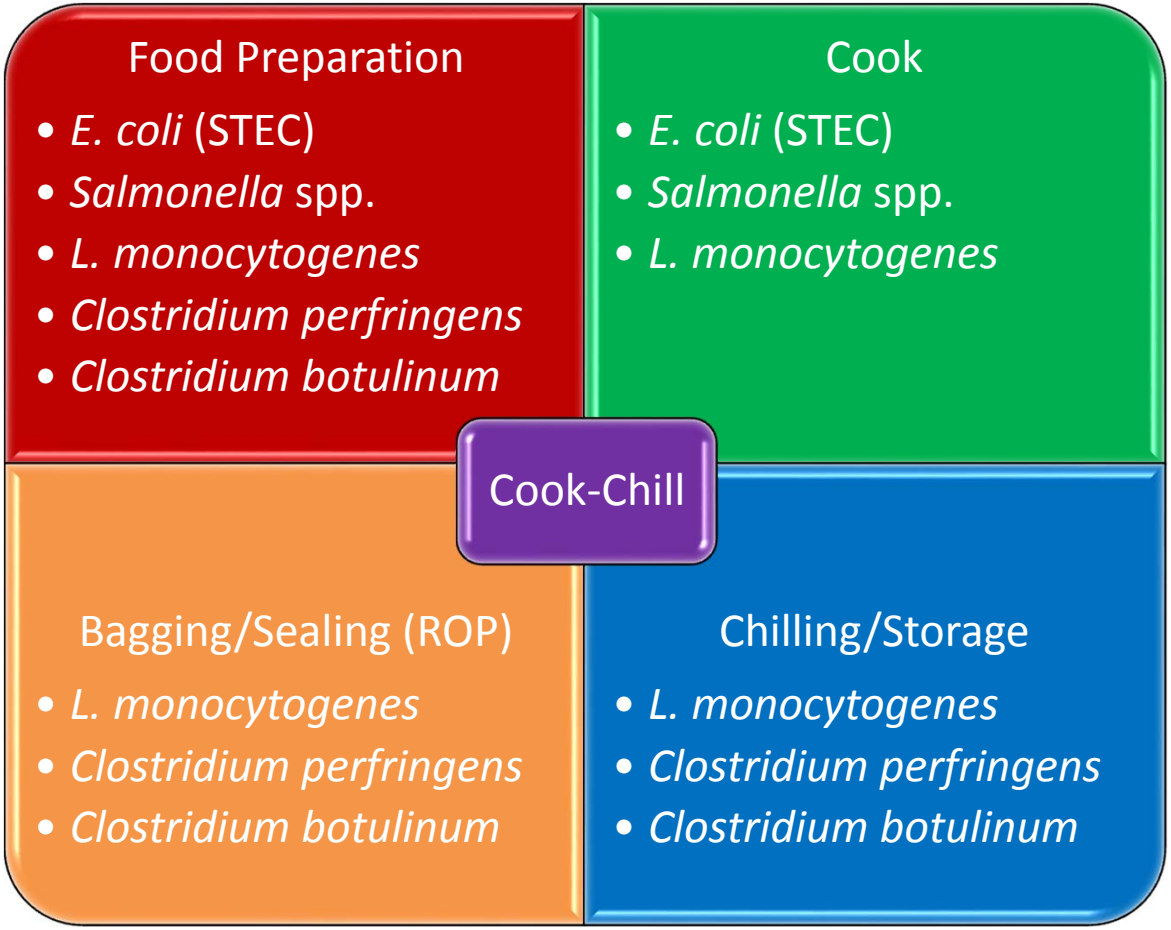
Food Safety Overview

Foodborne pathogens are a concern at each step of the cook-chill process!



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Process Steps

Food Preparation

- Preparation same for
  - Cook-Chill
  - Cook-in-Bag
  - Sous Vide
- Food products can be prepared as normal
  - Do not need to pre-cook
  - Allows for premixing of ingredients
  - Allows for separation of ingredients (if desired)
- Can prepare food for immediate use or for use at a later date
- Allows for batching of products
  - Can split batches half for now half for later

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Food Preparation

Involves all of the following:

- Cleaning of work area (pre-prep)
- Setting up equipment (pre-prep)
- Mixing of raw ingredients
- Chopping or dicing of vegetables
- Blending and Puree
- Weighing of ingredients

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department

Food Preparation

- Also Involves:
  - Cutting of meat
  - Scaling of fish
  - Marinating
  - Seasoning and dry rubs
  - Any other pre-cook process
- Cook-in-Bag
  - Bagging
  - Sealing

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department

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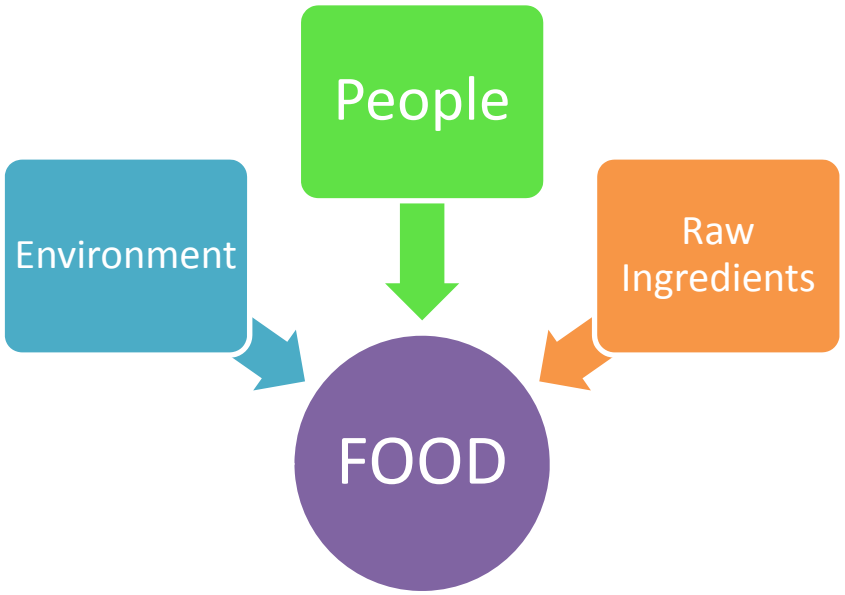
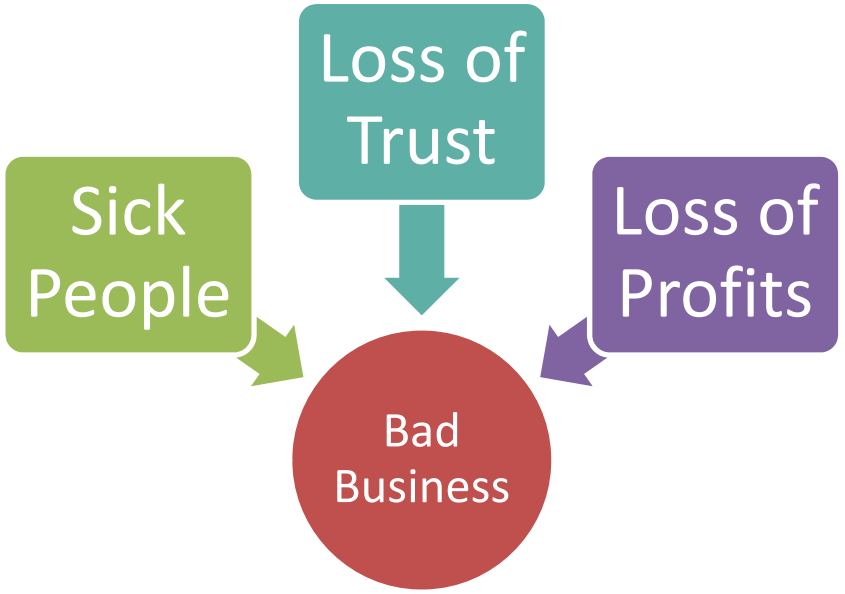
Safety Concerns During Prep

Raw Ingredients = Food Safety Risks!!!

- Foodborne pathogens come from multiple sources



- Pathogens cause disease resulting in:



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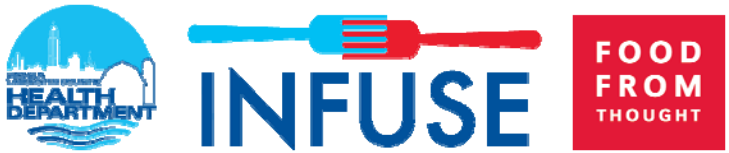
Causes of Contamination During Prep

- Environment
  - Poor sanitation practices
    - Dirty preparation areas (walls, floors, table tops)
    - Unclean cooking equipment or utensils
    - Pest control issues
  - *L. monocytogenes*
    - Lives in the environment and transfers to food
    - Can hide in cracks in floors
    - Can survive and grow at cool temperatures below 20°C

These are all contributing factors in Foodborne Illnesses



Causes of Contamination During Prep

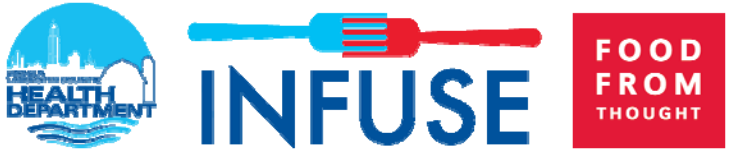
- Employees, Maintenance Workers, Visitors
  - Poor hygiene practices
    - Not washing hands
    - Not wearing gloves
    - Hair nets
    - Sneezing or coughing on food
  - *Escherichia coli* O157:H7 and Shiga Toxin Producing *E. coli*
    - Found on raw meat and vegetables
  - Also, *S. aureus*!

These are all contributing factors in Foodborne Illnesses

Causes of Contamination During Prep

- Cross contamination
  - Raw juices from meat touch other food products
  - Not separating raw and cook utensils
- *Salmonella* spp.
  - Found naturally on skin of chicken and other poultry
  - Causes Salmonellosis
  - *Salmonella* spp. and *Campylobacter* spp. (another foodborne bacteria) are the of the leading causes of foodborne illness
- Naturally occurring pathogens from ingredients

These are all contributing factors in Foodborne Illnesses



Process Steps

Cooking

Cook step different for each of the methods

- Cook-Chill
  - Cooking is second step in process
  - Lots of cooking options
  - Happens prior to bagging
  - Product is hot filled into bags
    - Potential food safety risk
- Cook-in-Bag and Sous Vide
  - Cooking is third step of process
  - Bagging of food happens prior to cooking
  - Only a couple of cooking options
    - Low temperature cooking
  - Less risk for contamination

Cooking

Cooking methods include:

- Baking
- Boiling
- Braising
- Broiling/grilling
- Pan-frying
- Roasting
- Deep frying
- Sautéing
- Steaming

Photos courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department

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Cooking

- Cook-in-Bag or Sous Vide methods include:
  - Boiling
    - Water bath
    - Stove top kettles
  - Steaming
    - Steam chambers
- Sealed bags are placed directly into water or steam
- Cook times/temperatures vary by product

Photos courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department

Photo from: https://upload.wikimedia.org/wikipedia/commons/thumb/a/a2/Sous_Vide_Cooking.jpg/220px-Sous_Vide_Cooking.jpg

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Picking a Sous Vide Unit

- Consider the following
  - Sous Vide bath capacity
  - Cooking capacity
  - Temperature Display/Control
    - Digital, dial – changeable?
    - Can it be calibrated?
    - Temperature range
    - Readings in C or F
  - Preheating time of bath
  - Circulator / No Circulator
  - Timers/auto shut off
- All affect cooking time
  - Preheating time of bath
  - Circulator / No Circulator
  - Timers/auto shut off

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Manufacturers and Options

ANOVA Culinary Precision Cookers	$
Sansaire Immersion Circulator	$
SousVide Supreme Water Oven	$$
Stainless Steel Stock Pot	$$
Vollrath Circulator Head & Water Bath with Cover	$$
Commercial Steam Ovens: Sterling	$$$
Commercial Steam Ovens: Convotherm	$$$$
DC Norris Sous Vide cook and chill systems	$$$$

http://www.dcnorris.com/images/content/tier/43_1_600x375.jpg

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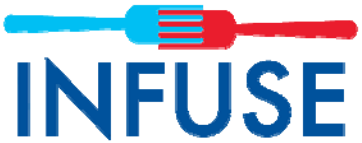
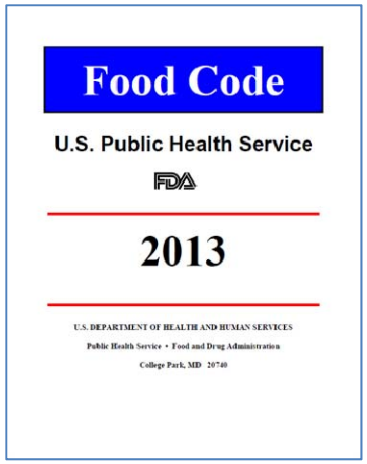
Regulations and Food Safety



FDA Food Code 2013

- Food safety rules and regulations for retail and food services industries
- Updated every 4 years
  - Last updated 2013 (due for update)
- In place to help food service establishments prevent foodborne illness outbreaks

- Food Code Supplement
  - Immediate changes issued between updates
  - Last supplement released 2013



http://www.fda.gov/foodcode

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Cooking Requirements

- Food Code 3-401.11
  - Requirements for raw animal parts
  - Product specific
  - 63˚C (145˚F) or above for 15 sec
    - Raw Eggs
    - Fish
    - Meat
  - 68˚C (155˚F) for 15 sec
    - Ratites (ostrich, emu)
    - Mechanically tenderized meats, injected meats
  - 74˚C (165˚F) for 15 sec
    - Poultry
    - Baluts (fertilized eggs)
    - Stuffed fish, stuffed meats
    - Pasta (stuffed)
  - Plant Food 3-401.13
    - Any “Plant Food” (fruits or vegetables)
    - Prepared for hot holding
    - Cooked to 57°C (135°F)

Food Code Cooking Charts

Temperature °C (°F)	Time in Minutes
54.4 (130)	112
55.0 (131)	89
56.1 (133)	56
57.2 (135)	36
57.8 (136)	28
58.9 (138)	18

Temperature °C (°F)	Time in Seconds
66.1 (151)	54
67.2 (153)	34
68.3 (155)	22
69.4 (157)	14
70.0 (158)	0

Same as USDA-FSIS Appendix A

Adapted from: FDA, 2013. Food Code 2013. US Department of Health and Human Services. US Department of Commerce, USA. Report number PB2013-110462, ISBN 978-1-935239-02-4. 3-401.11(B)(2), Pg 81, Table. 2013.

Cooking Requirements

Time required to pasteurize meat, poultry and fish

Thickness (mm)	55 °C 131 °F	56 °C 132.8 °F	57 °C 134.6 °F	58 °C 136.4 °F	59 °C 138.2 °F	60 °C 140 °F
5	3:33	2:41	2:00	1:30	1:08	0:51
10	3:35	2:43	2:04	1:36	1:15	1:00
15	3:46	2:55	2:16	1:48	1:28	1:13
20	4:03	3:11	2:32	2:04	1:44	1:28
25	4:17	3:25	2:46	2:18	1:57	1:41
30	4:29	3:38	3:00	2:32	2:11	1:55
35	4:45	3:53	3:15	2:46	2:25	2:09
40	4:59	4:07	3:29	3:00	2:39	2:22
45	5:21	4:29	3:50	3:22	3:00	2:42
50	5:45	4:53	4:14	3:44	3:21	3:03
55	6:10	5:18	4:39	4:08	3:45	3:26
60	6:38	5:45	5:06	4:35	4:10	3:50
65	7:07	6:15	5:34	5:02	4:36	4:15
70	7:40	6:45	6:03	5:30	5:04	4:42

Baldwin, D. 2012. Sous vide cooking: A Review. International Journal of Gastronomy and Food Science 1 (2012). Pg 20, Table 2.

Cooking Requirements

Time required to pasteurize meat, poultry and fish

Thickness (mm)	61 °C 141.8 °F	62 °C 143.6 °F	63 °C 145.4 °F	64 °C 147.2 °F	65 °C 149 °F	66 °C 150.8 °F
5	0:40	0:31	0:25	0:20	0:17	0:14
10	0:49	0:41	0:35	0:30	0:27	0:24
15	1:02	0:53	0:47	0:42	0:38	0:35
20	1:17	1:08	1:01	0:56	0:52	0:48
25	1:30	1:21	1:13	1:08	1:03	0:59
30	1:43	1:33	1:26	1:19	1:14	1:10
35	1:56	1:46	1:38	1:31	1:26	1:21
40	2:09	1:59	1:50	1:43	1:37	1:32
45	2:29	2:17	2:08	2:00	1:53	1:48
50	2:49	2:37	2:27	2:19	2:11	2:05
55	3:11	2:58	2:47	2:38	2:30	2:23
60	3:34	3:20	3:09	2:58	2:50	2:42
65	3:58	3:43	3:31	3:20	3:11	3:02
70	4:23	4:08	3:54	3:43	3:32	3:23

Baldwin, D. 2012. Sous vide cooking: A Review. International Journal of Gastronomy and Food Science 1 (2012). Pg 20, Table 2.

Regulations – USDA FSIS

- Mostly meat and poultry products
- Federal Code of Regulations (CFR)
- 7 CFR 60.107
  - Food Service Establishments
  - …retail establishments that provide ready-to-eat foods that are consumed either on or outside of the retailer's premises…
- 9 CFR 318.17
  - Cooked beef requirements
  - Lethality – 6.5 log reduction of *Salmonella*
- 9 CFR 381.150
  - Cooked poultry requirements
  - Lethality – 7.0 log reduction of *Salmonella*
- *C. botulinum* growth not allowed!

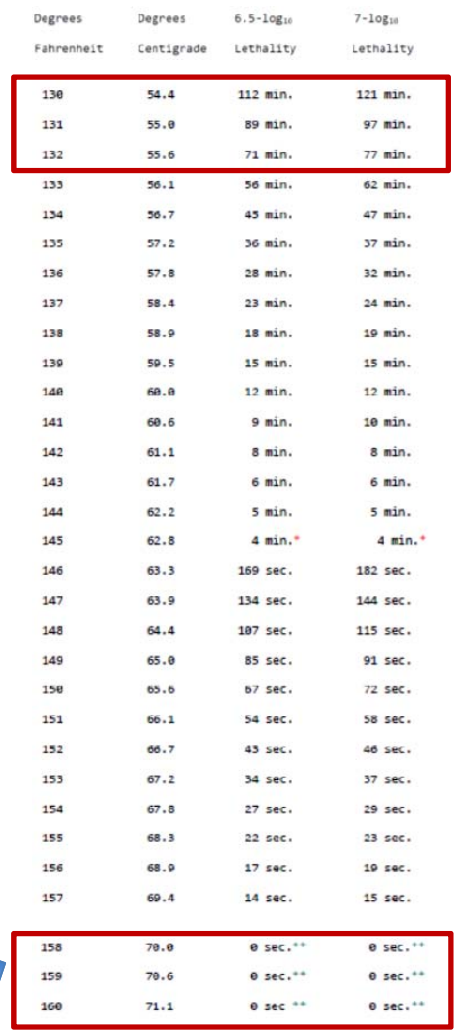
Appendix A

- Cook Regulations
- Guidance for meat and poultry
  - Time / temperature dependent
  - Internal Temperature

Minimum Internal Temperature

Minimum Processing Time
(After Internal Temperature Achieved)

Degree Fahrenheit	Degree Centigrade	6.5 Log Reduction Lethality	7.0 Log Reduction Lethality
130	54.4	112 min	121 min
131	55.0	89 min	97 min
132	55.6	71 min	77 min
157	69.4	14 sec	15 sec
158	70.0	0 sec	0 sec
159	70.6	0 sec	0 sec
160	71.1	0 sec	0 sec



Degrees Fahrenheit	Degrees Centigrade	6.5-$\log_{10}$ Lethality	7-$\log_{10}$ Lethality
130	54.4	112 min.	121 min.
131	55.0	89 min.	97 min.
132	55.6	71 min.	77 min.
133	56.1	56 min.	62 min.
134	56.7	45 min.	47 min.
135	57.2	36 min.	37 min.
136	57.8	28 min.	32 min.
137	58.4	23 min.	24 min.
138	58.9	18 min.	19 min.
139	59.5	15 min.	15 min.
140	60.0	12 min.	12 min.
141	60.6	9 min.	10 min.
142	61.1	8 min.	8 min.
143	61.7	6 min.	6 min.
144	62.2	5 min.	5 min.
145	62.8	4 min.*	4 min.*
146	63.3	169 sec.	182 sec.
147	63.9	134 sec.	144 sec.
148	64.4	107 sec.	115 sec.
149	65.0	85 sec.	91 sec.
150	65.6	67 sec.	72 sec.
151	66.1	54 sec.	58 sec.
152	66.7	43 sec.	46 sec.
153	67.2	34 sec.	37 sec.
154	67.8	27 sec.	29 sec.
155	68.3	22 sec.	23 sec.
156	68.9	17 sec.	19 sec.
157	69.4	14 sec.	15 sec.
158	70.0	0 sec.**	0 sec.**
159	70.6	0 sec.**	0 sec.**
160	71.1	0 sec **	0 sec.**

Adapted from USDA FSIS, 1999. "Appendix A: Compliance Guidelines For Meeting Lethality Performance Standards For Certain Meat And Poultry Products." June 1999. Guidelines for Cooked Beef, Roast Beef, and Cooked Corned Beef table.

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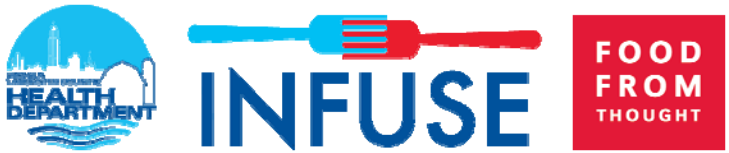
Things to Consider

- Safety First!!!!
  - Food safety is a combination of time and temperature
  - Meats – 55-70°C
    - 1-48 hours or more
  - Vegetables – 84-87°C
    - 1-4 hours
  - Fish – 47-60°C
    - 20-40 minutes
- Food Code
  - Unpasteurized food cannot be held between 41°F (5°C) and 130°F (54.5°C) for more then 4 hours
- Raw or unpasteurized foods should never be consumed by susceptible individuals

These are just suggestions, many time temperature combinations are available to create safe high quality sous vide products!



Safety Concerns

- Cooking is main source of control of foodborne pathogens
  - But is not to be used as a substitute for good food safety practices
- Kills most vegetative cells
  - *E. coli*
  - *Salmonella* spp.
  - *L. monocytogenes*
- *Clostridium* can survive cook process!!!
  - Produces heat resistant spores
  - Spores then germinate (wake up) when in favorable environment

Organisms of Concern: Cook-in-Bag

Organism of Concern	Resistance to Heat Treatment	Minimum Growth Temperature
Clostridium botulinum Vegetative Cells	20-30 minutes @ 80°C	3.3°C
C. botulinum Toxin	10 minutes @ 80°C	N/A
Listeria monocytogenes	2 minutes @ 70°C	0°C
Yersinia enterocolitica	12 minutes @ 66°C	0°C

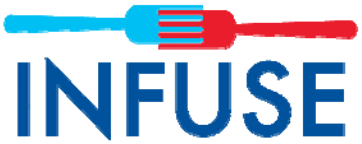
Adapted from: Church and Parsons 1993. Review: sous vide cook-chill technology. International Journal of Food Science and technology (1993). v28, pg 564, Table 1.

Outline

- History
- Cook Chill Defined
- Definitions and Terms
- Cook chill Process Steps and Safety
- Regulations
- Processing Considerations
- Summary

Summary

- Types
  - Cook-Chill
  - Cook-in-Bag
  - Sous Vide
- Can be used for prep of all types of food
- 4 Main Steps
  - Food Preparation
  - Cooking
  - Bagging/Sealing (ROP)
  - Chilling
- Food Safety is a concern
  - Employees
  - Cross contamination
  - Raw ingredients
- Pathogens of concern
  - *E. coli*
  - *Salmonella* spp.
  - *L. monocytogenes*
  - *C. botulinum*



Lets take a break!!!

Photo from: https://facs-4-life.wikispaces.com/file/view/fs.jpg/230109956/fs.jpg

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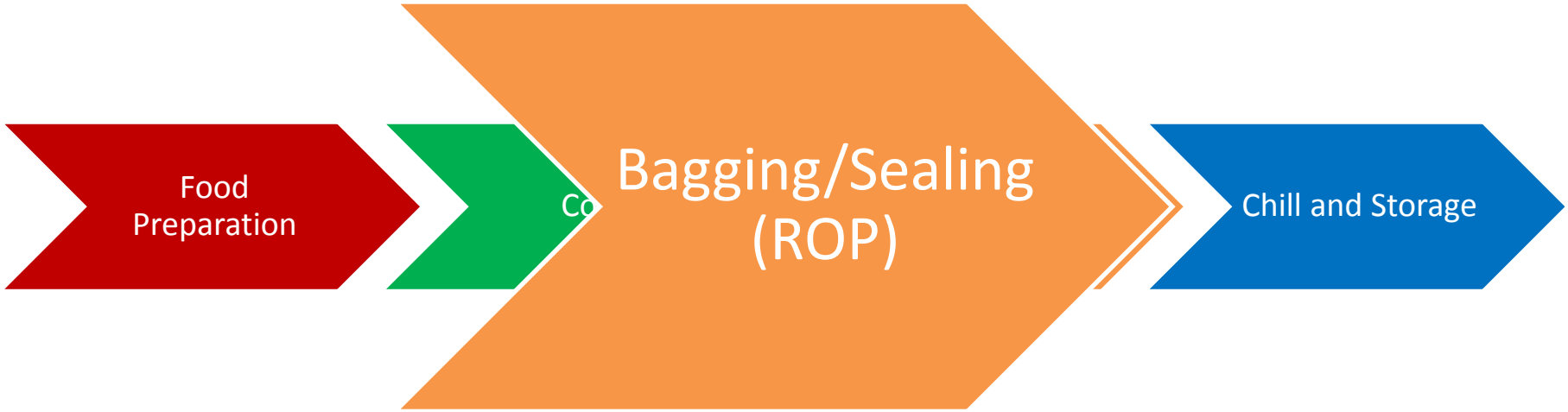
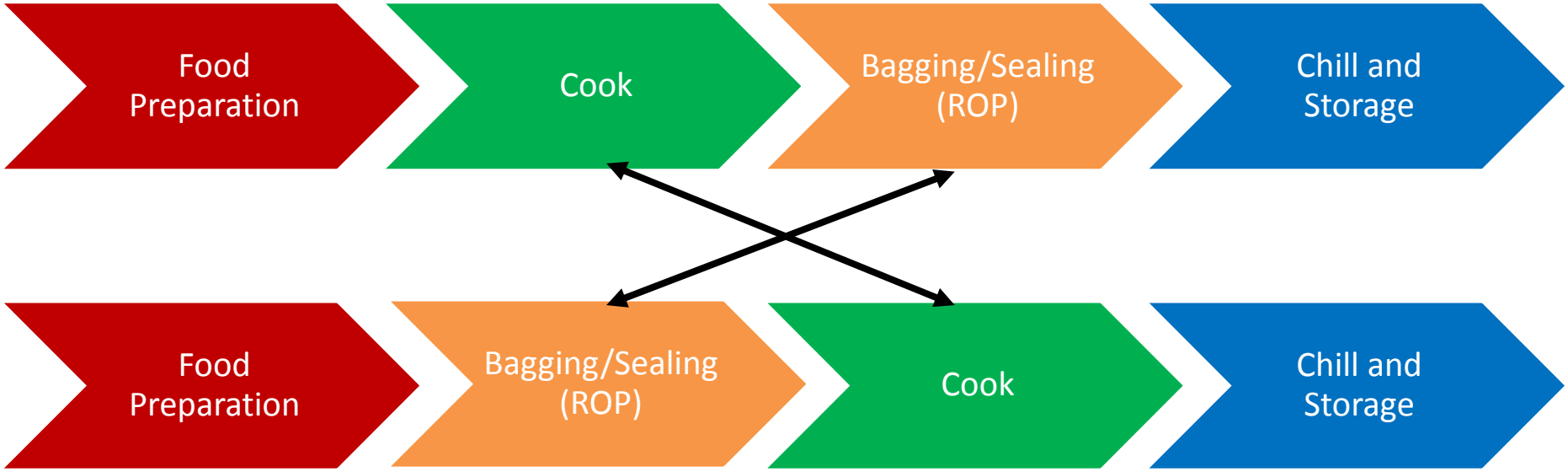
Process Steps



Bagging and Sealing

Happens at different steps depending upon the process…

Cook-Chill



Cook-in-Bag or Sous Vide

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Bagging and Sealing

- Cook-Chill
  - Third step of the process
  - Product is hot filled into bags
    - Placed into pouch prior to cooling below 57°C (135°F)
    - Potential for post-cooking contamination
  - Usually just heat sealed or pressed closed
    - Ziploc bags

- Cook-in-Bag and Sous Vide
  - Bagging and sealing done prior to cooking
  - Cook-in-Bag
    - Heat sealed in pouch
    - Ziplocs
    - Other closable water tight pouches
  - Sous Vide
    - Heat sealed
    - Vacuum sealed

Reduced Oxygen Packaging (ROP)

- Common ROP processes used by food industry:
  - Vacuum Packaging
  - Modified Atmosphere Packaging
  - Controlled Atmosphere Packaging
  - **Cook-Chill Processes**
  - **Cook-in-Bag**
  - **Sous Vide**

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Reduced Oxygen Packaging (ROP)

ROPs contain less oxygen than environment (< 21%):

Positive

- Inhibits spoilage organisms
- Extends shelf life
- Improves food safety
- Less handling
- Less labor
- Portion control
- Quality retention

Negative

- Bagging is a potential step for contamination in the cook/bag/chill process
- Increased risk for:
  - *Listeria monocytogenes*
  - *Bacillus cereus*
  - *Clostridium perfringes*
  - *Clostridium botulinum*

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Methods of Sealing

Ziploc / Hand Sealable Bags: Minimal to no air removal

- Advantages:
  - Simple and fast
  - Cheapest method
- Disadvantages:
  - Leaves some oxygen behind
  - Greater potential for leakers

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

Methods of Sealing

Heat Sealing: Minimal to no air removal

- Advantages:
  - Fairly simple
  - Cheaper then vacuum sealing
  - Can create oxygen reduced environment
- Disadvantage:
  - Leaves some oxygen behind

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

Methods of Sealing

Vacuum sealing: Air removed to desired level

- Advantages:
  - Shelf life improved
  - Better food quality
  - Less oxidation
  - Creates microaerophilic or anaerobic environment
- Disadvantage:
  - Increased risk for anaerobic pathogens

Photos courtesy of Eric L Oliver, MSc. 2017.

Food Code 3-502.12: Reduced Oxygen Packaging without a Variance

- Safety concerns:
  - Growth and toxin formation of *Clostridium botulinum*
  - Growth of *Listeria monocytogenes*
- Hazard controls for ROP:
  - Fish should be packaged under ROP only if maintained frozen before, during, and after packaging
  - Time/Temperature
    - Product must be labeled with the production time and date,
    - Held at 5°C (41°F) or less during refrigerated storage, and
    - Removed from its package within 48 hours after packaging

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Food Code 3-502.12: Reduced Oxygen Packaging without a Variance

- Hazard controls for ROP:
  - Cook-Chill or Sous Vide
    - HACCP plan is required
    - Cooking to heat all parts of food to temperature and time as specified
    - Placed into pouch prior to cooling below 57°C (135°F), if cooked outside of bag
    - Chilling following prescribed profile

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

Food Code 3-502.12: Reduced Oxygen Packaging without a Variance

- Hazard controls for ROP:
  - Multiple barriers
    - HACCP plan is required
    - Primary barrier:
      - Storage temperature 5°C (41°F)
    - Secondary barrier(s)
      - α_w of ≤ 0.91
      - pH of ≤ 4.6
      - Cured, USDA inspected meat or poultry products using substances specified in 9 CFR 424.21
      - High levels of competing microorganisms (i.e. raw meat, poultry or vegetables)

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Food Code 3-502.12: Reduced Oxygen Packaging without a Variance

- Hazard controls for ROP:
  - Multiple barriers

Barrier	*C. botulinum*	*L. monocytogenes*
$\alpha_w \leq 0.91$	Will not produce toxin	Will not grow (growth ≥ 0.92)
pH ≤ 4.6	Will not produce toxin	Will not grow at refrigerated temps
Cured Meat/Poultry	Nitrites inhibit growth	N/A
Competing Microorganisms	Out competed for growth nutrients	Out competed for growth nutrients

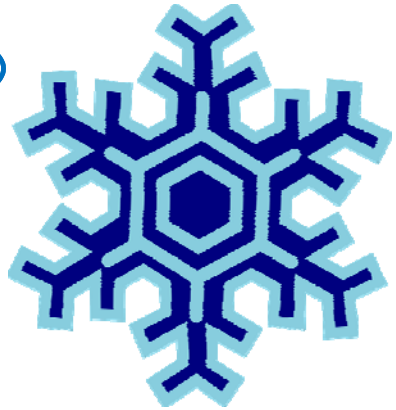
Process Steps

Chilling

- Requirements are the same for:
  - Cook-Chill
  - Cook-in-Bag, Sous Vide
- Goal is to chill food as quickly as possible
  - Quality
  - Food Safety
    - To prevent germination of spores
    - To prevent bacterial growth

Chilling Processes

- Regulations do not specify cooling mechanisms
- What are the options?
  - Ice bath (50:50 ice and water)
    - Stainless steel barrel, sink, tub or vat
  - Circulating chilled water bath
  - Water vats in cold rooms
  - Industrial chillers
    - Kettles, blast chillers, water jet chillers, tumble chillers



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Chilling Processes

Ice Bath

Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

- Container should be large enough to hold product pouches
- ~50:50 ice and water
  - Temp 41°F (5°C)
- Fully submerge product
  - Add additional ice throughout chilling as needed to maintain temps
- Chill time dependent on product
  - Thickness
  - Amount of pouches

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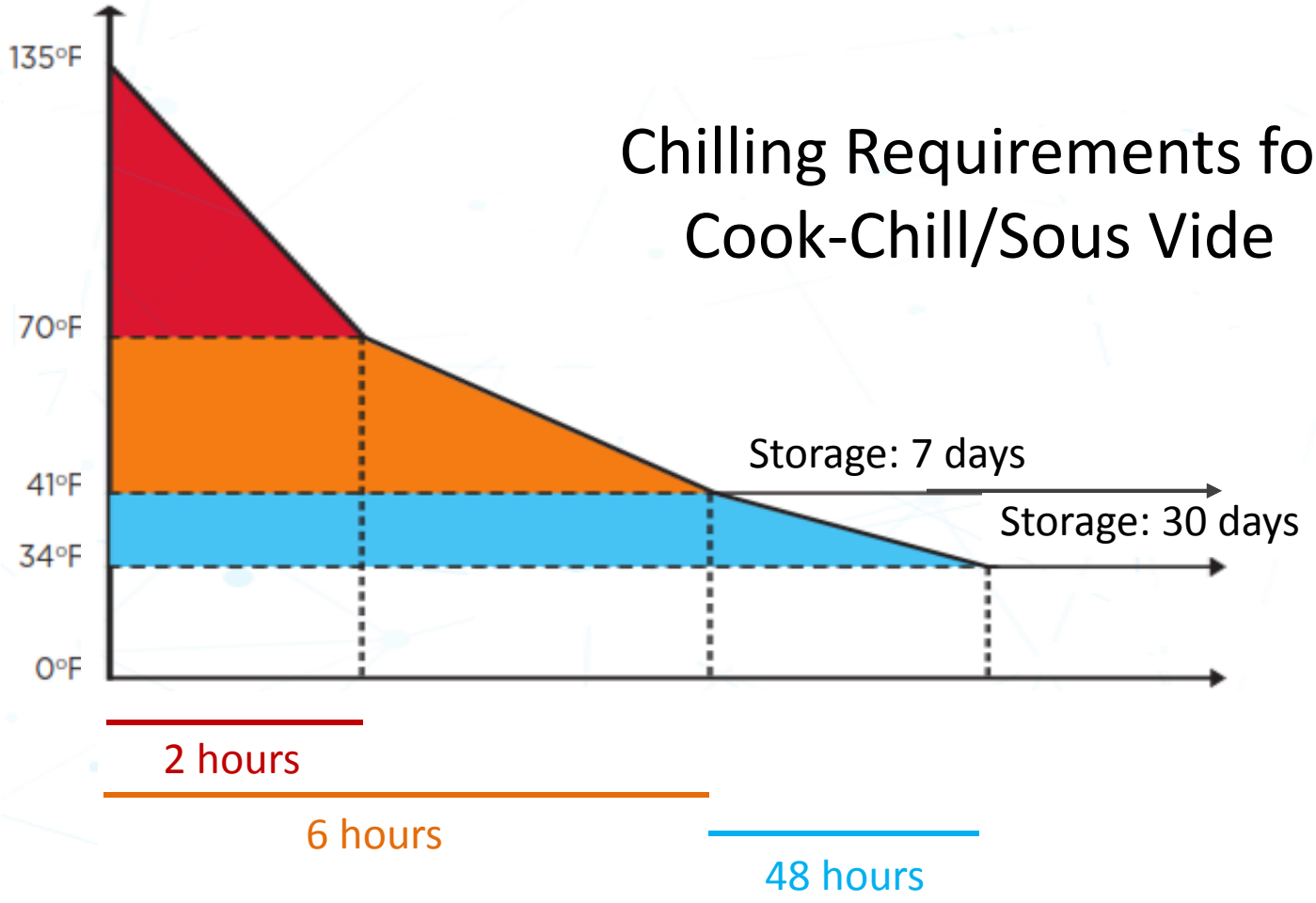
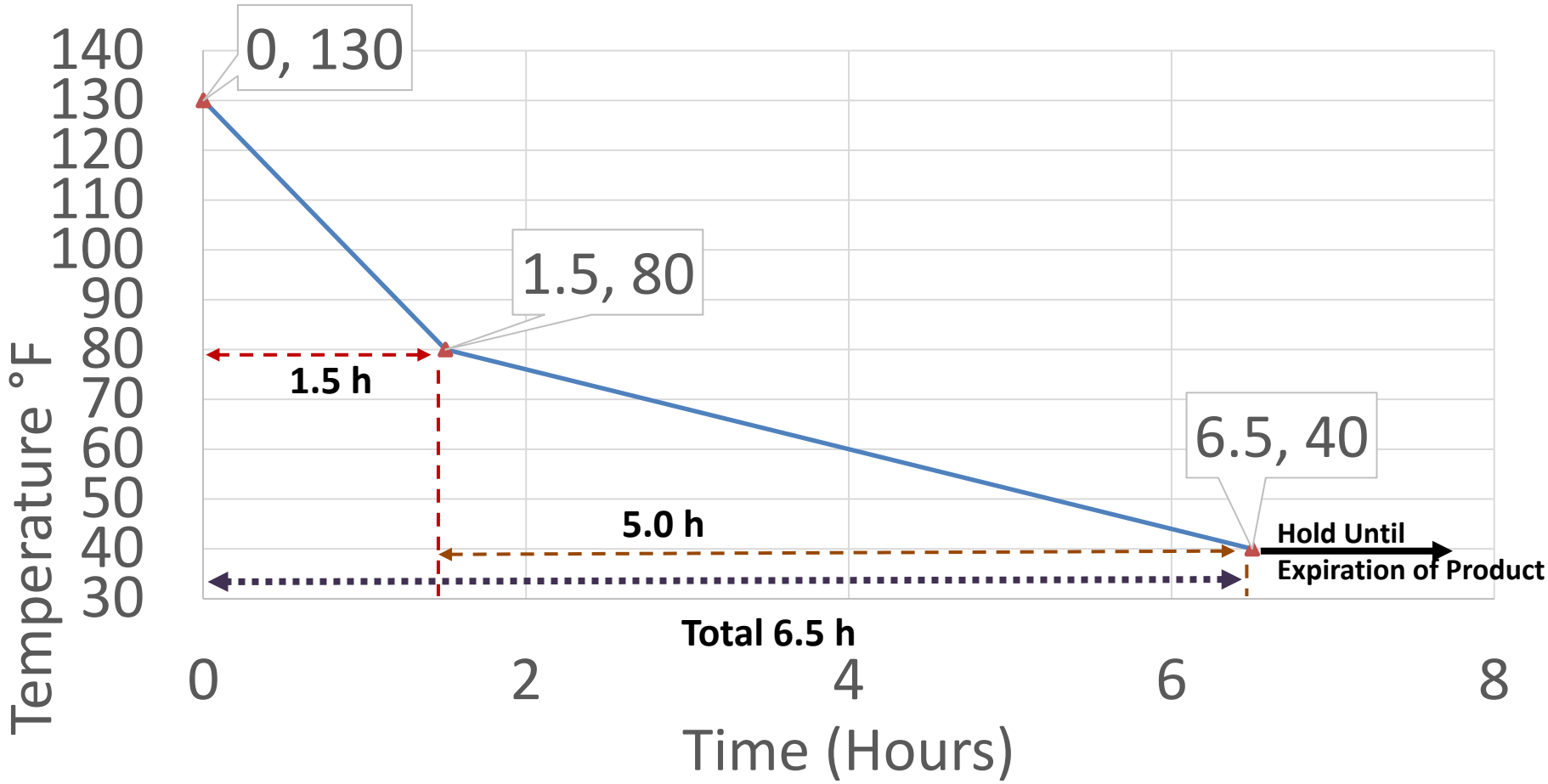
FDA Chilling Requirements



USDA-FSIS Appendix B – Chilling



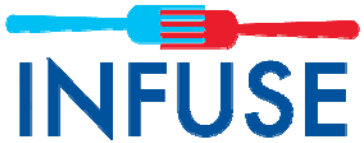
Factors Affecting Chilling

Product Dimensions

Approximate cooling time from 55–80°C (130–175°F) to 5°C (41°F) in an ice water bath (50:50 water and ice).

Thickness (mm)	Slab-like	Cylinder-like	Sphere-like
5	5 min	3 min	3 min
10	14 min	8 min	6 min
15	25 min	14 min	10 min
20	35 min	20 min	15 min
25	50 min	30 min	20 min
30	$1\frac{1}{4}$ h	40 min	30 min
35	$1\frac{1}{2}$ h	50 min	35 min
40	$1\frac{3}{4}$ h	1 h	45 min
45	$2\frac{1}{4}$ h	$1\frac{1}{4}$ h	55 min
50	$2\frac{3}{4}$ h	$1\frac{1}{2}$ h	1 h

Baldwin, D. 2012. Sous vide cooking: A Review. International Journal of Gastronomy and Food Science 1 (2012). Pg 25, Table 3.



Cold Storage

- Product safety relies on strict temperature control
  - *L. monocytogenes* can grow at refrigerated temperatures over long periods of time
  - *C. botulinum* spores can grow if food is temperature abused
    - Growth at temperature of 2-8°C
- Product quality influenced by temperature control
  - Spoilage organisms
  - Shorter shelf life
    - Taste
    - Texture
    - Smell

Keeping food stored appropriately will help control both spoilage and food safety organisms!

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage

- Actions:
  - Clean and sanitize prep area
  - Peel potatoes and prepare for boiling
- Hazards:
  - Contamination from personnel
  - Cross-contamination
- Microorganisms of concern:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage

- Actions:
  - Place potatoes in pot/stove
  - Cook at 183°F (83.9°C) or higher for 2.5-4 hours
- Lethality step for:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Listeria monocytogenes
  - *Clostridium perfringes*
  - *Clostridium botulinum*
  - *Bacillus cereus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage

- Actions:
  - Mash or blend potatoes
- Hazards:
  - Contamination from personnel
  - Cross-contamination
- Microorganisms of concern:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage

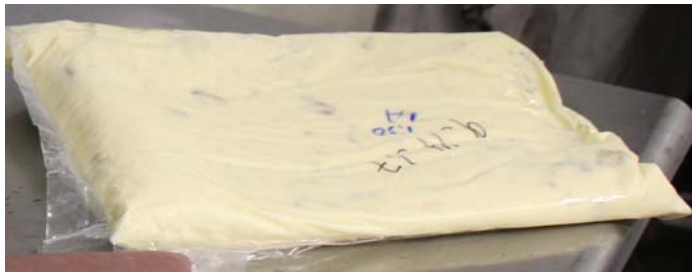


Photo courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

- Actions:
  - Hot fill into pouches before cooling to 57°C (135°F)
  - Keep bags to a thickness of 1-2 inches
  - Heat seal pouches
- Hazards:
  - Contamination from personnel
  - Cross-contamination
- Microorganisms of concern:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - *Listeria monocytogenes*
  - Norovirus

HEALTH DEPARTMENT

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FOOD FROM THOUGHT

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage

- Actions:
  - Place sealed bags in ice bath
  - Cool food according to cooling profile
  - Potatoes must reach ≤ 5°C (41°F) within 6 hours
- Hazards:
  - Spore germination
  - Bacterial growth
- Microorganisms of concern:
  - *Clostridium botulinum*
  - *Clostridium perfringes*
  - *Bacillus cereus*

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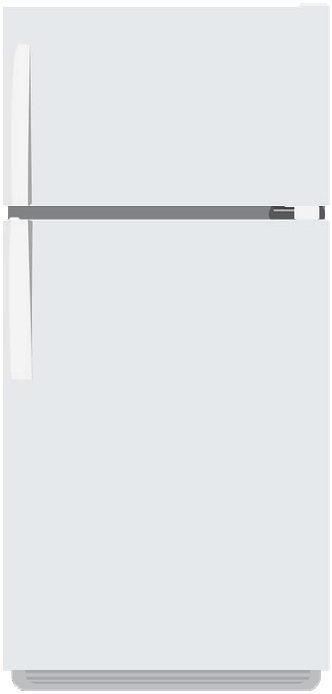
FOOD FROM THOUGHT

Mashed Potatoes

Food Preparation → Cook → Bagging/Sealing (ROP) → Chill and Storage



- Actions:
  - Place cooled bags in refrigerator
  - Hold for up to 7 days at 5°C (41°F)
- Hazards:
  - Microbial growth
- Microorganisms of concern:
  - *Listeria monocytogenes*
  - *Clostridium botulinum*

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FOOD FROM THOUGHT

Corned Beef Brisket

Food Preparation → Bagging/Sealing (ROP) → Cook → Chill and Storage

- Actions:
  - Clean and sanitize prep area
  - Cut brisket into 2 inch thick pieces or cook whole
- Hazards:
  - Contamination from personnel
  - Cross-contamination
- Microorganisms of concern:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Corned Beef Brisket

Food Preparation → Bagging/Sealing (ROP) → Cook → Chill and Storage

Photos courtesy of Ben Davy, Food Safety Consultant, Lincoln-Lancaster County Health Department.

- Actions:
  - Place brisket in pouch
  - Heat seal or vacuum seal reducing oxygen to < 21%
- Hazards:
  - Contamination from personnel
  - Cross-contamination
- Microorganisms of concern:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Corned Beef Brisket

Food Preparation → Bagging/Sealing (ROP) → Cook → Chill and Storage

- Actions:
  - Cook at 134°F (56.5°C) or higher for 12-30 hours
    - Thickness of product will affect cooking time
  - Check temperature of cooking unit to ensure consistent cooking
- Lethality step for:
  - *E. coli*
  - *Salmonella*
  - *Staphylococcus aureus*
  - Listeria monocytogenes
  - *Clostridium perfringes*
  - *Clostridium botulinum*
  - *Bacillus cereus*
  - Norovirus

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Corned Beef Brisket

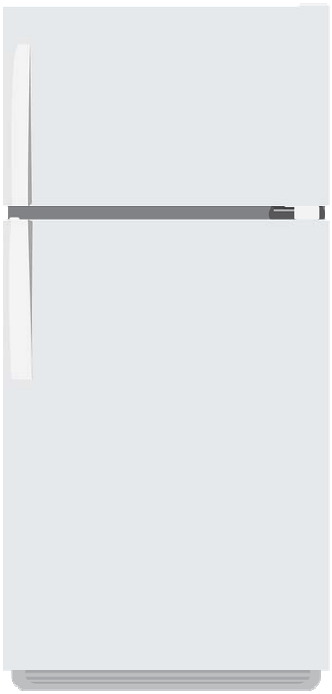
Food Preparation → Bagging/Sealing (ROP) → Cook → Chill and Storage

- Actions:
  - Place sealed bags in ice bath
  - Cool food according to cooling profile
  - Brisket must reach ≤ 5°C (41°F) within 6 hours
- Hazards:
  - Spore germination
  - Bacterial growth
- Microorganisms of concern:
  - *Clostridium botulinum*
  - *Clostridium perfringes*
  - *Bacillus cereus*

HEALTH DEPARTMENT INFUSE FOOD FROM THOUGHT

Corned Beef Brisket

Food Preparation → Bagging/Sealing (ROP) → Cook → Chill and Storage



- Actions:
  - Place cooled bags in refrigerator
  - Hold for up to 7 days at 5°C (41°F)
- Hazards:
  - Microbial growth
- Microorganisms of concern:
  - *Listeria monocytogenes*
  - *Clostridium botulinum*

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Remember…

"The ultimate responsibility for food safety at the retail level lies with retail and food service operators and their ability to develop and maintain effective food safety management systems."

FDA 2006. "Managing Food Safety: A Regulator's Manual For Applying HACCP Principles to Risk based Retail and Food Service Inspections and Evaluating Voluntary Food Safety Management Systems." US Department of Health and Human Services. Center for Food Safety and Applied Nutrition. OMB Control No. 0910-0578.

Cook-Chill Method for Retail and Restaurants

Jayne Stratton, Ph.D.
Andreia Bianchini, Ph.D.

THE FOOD PROCESSING CENTER

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